



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/854,975	05/14/2001	William A. Polinsky	MTI-31267	9089

31870 7590 05/06/2003

WHYTE HIRSCHBOECK DUDEK S.C.
111 E. WISCONSIN AVE.
SUITE 2100
MILWAUKEE, WI 53202

EXAMINER

UMEZ ERONNI, LYNETTE T

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 05/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/854,975

Applicant(s)

POLINSKY ET AL.

Examiner

Lynette T. Umez-Eronini

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1, 11, and 16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, line 7; and

In claim 11, line 7; "a thickness at least equal to the target depth" is indefinite because it is unclear what is the magnitude of the target depth.

In claim 1, line 13; and

In claim 11, line 13; "predetermined" is indefinite because it reads on a nebulous mental step conducted prior to the manipulative steps of the claimed invention, hence renders the present process claims unclear in meaning and scope. If applicant wishes to patent detailed controls over the recited process, they must be positively recited. It is suggested that "predetermined" be deleted.

In claim 1, line 14 and 17;

In claim 8, line 2;

In claim 9, line 2;

In claim 10, line 2;

In claim 11, lines 14 and 17;

In claim 19, line 2;

In claim 20, line 2;

In claim 21, line 2; "target depth" is indefinite because its meaning is unclear. It is unclear what is a target depth as compared to a generic depth.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Doan (US 5,346,585) in view of Laxman (US 5,774,196) in view of Yao et al. (US 5,814,564)

As pertaining to **claims 1, 6, and 7**, Doan teaches a method for facet etching a semiconductor device to a target depth. The method comprises the steps of:

forming a first layer comprising an insulating material superjacent a substrate comprising a plurality of conductive structures (5), at least some of the conductive structures (5) being placed apart to form spaces between the conductive structures (Figure 4), such that the first layer forms in at least some of the spaces between the conductive structures (column 3, lines 29-41);

etching the first layer in a first etch by directing a plasma beam at the first layer formed in at least some of the spaces between the conductive structures, wherein the plasma is of sufficient energy to sputter material from the first layer and the plasma is an

Art Unit: 1765

ion of an inert gas thereby forming a facet etch in the first layer formed in the spaces between the conductive structures (column 3, lines 57-63 and column 4, lines 40-51)

Doan differs in failing to teach:

the first layer is formed to a thickness at least equal to the target depth, **as in claim 1** and to specify the depth in which the first etch is terminated with respect to the target depth, as recited in **claims 8-10**.

Laxman teaches, "Purity of the film, thickness, uniformity and deposition rates are some of the strictly controlled parameters to facilitate fabrication of submicron features in a device"(column 2, lines 57-59).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Doan by forming features in a device by controlling film thickness as taught by Laxman, which provides evidence that film (layer) thickness is a so called "result effective variable" since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 05 USPQ 215 (CCPA 1098).

Doan in view of Laxman differs only in failing to teach:

terminating the first etch when the first layer has been etched to a predetermined depth which is less than the target depth;

etching the first layer in a second etch by contacting the first layer with a reactive chemical gas/plasma; and

terminating the second etch when the first layer has been etched to the target depth, **in claim 1**.

Yao teaches a method of etching back an oxide layer **30** by employing six etching steps (Abstract). In step 3, oxide layer **30** is etched using CF_4 and CHF_3 gases and argon for 90 ± 20 seconds (column 5, line 31 - column 6, line 5 and Table 1, column 4) and is etched in a sputter step between 3 and 8 seconds (5 ± 2) in step 4 (column 5, lines 7-10 and Table 1, column 5). Although Yao's etching steps are labeled "Etch High," "Etch Low," "Sputter," and "Plasma," they are all etching processes that differ only in the operational conditions. Since each of these steps are performed at a specified time, then using Yao's steps of etching an oxide layer would result in,

terminating the first etch when the first layer has been etched to a depth; etching the first layer in a second etch by contacting the first layer with a reactive chemical gas/plasma; and terminating the second etch when the first layer has been etched.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Doan in view of Laxman by using Yao's method of terminating the first etch when the layer has been etched to a depth; etching the layer with a second by contacting the layer with a reactive chemical gas/plasma; and terminating the second etch when the layer has been etched for the purpose of minimizing the risk of over-etching the etched layer.

Doan further teaches, "an insulator layer **3** (same as applicant's first layer), such as TEOS, an oxide . . . or other suitable dielectric is disposed, preferably by deposition,

Art Unit: 1765

superjacent the features **5** by any suitable method known in the art" (column 3, lines 35-39), which reads on,

the first layer is formed by means of chemical vapor deposition, **as in claim 2**;

and the first layer comprises silicon dioxide, **as in claim 3**.

Doan teaches features **5** (same as applicant's conductive structures) comprises conductive layer **5c** such as polysilicon and **5b** such as tungsten silicide (column 3, lines 29-32), which reads on,

wherein the conductive structures form at least one of metal lines, **in claim 4**;
and at least one of silicides, **in claim 5**.

5. Claims 11-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Doan ('585) in view of Laxman ('196) and Yao ('564) and further in view of Lee (US 5,935,875).

As pertaining to **claims 11, 13, and 17** Doan teaches a method for facet etching a semiconductor device to a target depth. The method comprises the steps of:

forming a first layer comprising an insulating material superjacent a substrate comprising a plurality of conductive structures (**5**), at least some of the conductive structures (**5**) being placed apart to form spaces between the conductive structures (Figure **4**), such that the first layer forms in at least some of the spaces between the conductive structures and the first layer is formed to a thickness at least equal to the target depth (column 3, lines 29-41);

etching the first layer in a first etch by directing a plasma beam at the first layer formed in at least some of the spaces between the conductive structures, wherein the plasma is of sufficient energy to sputter material from the first layer and the plasma is an ion of an inert gas thereby forming a facet etch in the first layer formed in the spaces between the conductive structures (column 3, lines 57-63 and column 4, lines 40-51).

Doan differs in failing to teach:

the first layer is formed to a thickness at least equal to the target depth, **as in claim 11** and to specify the depth in which the first etch is terminated with respect to the target depth, as recited in **claims 19-21**.

Laxman teaches, "Purity of the film, thickness, uniformity and deposition rates are some of the strictly controlled parameters to facilitate fabrication of submicron features in a device"(column 2, lines 57-59).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Doan by forming features in a device by controlling film thickness as taught by Laxman, which provides evidence that film (layer) thickness is a so called "result effective variable" since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 05 USPQ 215 (CCPA 1098).

Doan in view of Laxman differs in failing to teach:

terminating the first etch when the first layer has been etched to a predetermined depth which is less than the target depth; etching the first layer in a second etch by

contacting the first layer with a reactive chemical gas/plasma; and terminating the second etch when the first layer has been etched to the target depth, **in claim 11**.

Yao teaches a method of etching back an oxide layer **30** by employing six etching steps (Abstract). In step 3, oxide layer **30** is etched using CF_4 and CHF_3 gases and argon for 90 ± 20 seconds (column 5, line 31 - column 6, line 5 and Table 1, column 4) and is etched in a sputter step between 3 and 8 seconds (5 ± 2) in step 4 (column 5, lines 7-10 and Table 1, column 5). Although Yao's etching steps are labeled "Etch High," "Etch Low," "Sputter," and "Plasma," they are all etching processes that differ only in the operational conditions. Since each of these steps is performed at a specified time, then using Yao's steps of etching an oxide layer would result in,

terminating the first etch when the first layer has been etched to a depth; etching the first layer in a second etch by contacting the first layer with a reactive chemical gas/plasma; and terminating the second etch when the first layer has been etched.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Doan in view of Laxman by using Yao's method of terminating the first etch when the layer has been etched to a depth; etching the layer with a second by contacting the layer with a reactive chemical gas/plasma; and terminating the second etch when the layer has been etched for the purpose of minimizing the risk of over-etching the etched layer.

Doan in view of Laxman and Yao differ in failing to teach forming a second layer comprising an insulating material superjacent the first layer, **in claim 11** and the second layer uniformly covers the first layer, **in claim 12**.

Lee shows a second insulating layer **115** is formed over a first insulating **113** (column 5, lines 29-32 and Figure **6**), which are the same as applicant's second layer **64** that covers first layer **16** in Figure **6** and Specification, page 6, line 10 of the claimed invention. Since Lee's second insulating layer is positioned over the first insulating layer in the same manner as that of the claimed invention, then using Lee's method of forming a second insulating layer over a first insulating layer would result in the second layer comprising an insulating material superjacent the first layer and the second layer uniformly covers the first layer as that of the claimed invention.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Doan in view of Laxman and Yao by using Lee's method of forming a second layer comprising an insulating material superjacent the first layer and uniformly covering the first layer for the purpose of protecting the first insulating layer during the formation of conductive contacts (Lee, column 5, lines 57-59).

Doan further teaches an insulator layer **3** (same as applicant's first layer), such as TEOS, an oxide . . . or other suitable dielectric is disposed, preferably by deposition, superjacent the features **5** by any suitable method known in the art (column 3, lines 35-39), which reads on,

the first layer is formed by means of chemical vapor deposition, **as in claim 13**;
and the first layer comprises silicon dioxide, **as in claim 14**.

Doan teaches features **5** (same as applicant's conductive structures) comprises conductive layer **5c** such as polysilicon and **5b** such as tungsten silicide (column 3, lines 29-32), which reads on,

wherein the conductive structures form at least one of metal lines, **as in claim 15**; and at least one of silicides, **in claim 16**.

Response to Arguments

6. Applicant's arguments filed February 24, 2003 have been fully considered but they are not persuasive. Applicant traverses the 112(2) rejection of claims 1, 8-11, 16, and 19-21. Applicant argues the term, "target depth" is clear from the claims, is fully described in the specification, and is a standard term of art. Applicant also argues the term, "predetermined depth" like "target depth" is a standard term found in numerous US Patents. Applicant argument is unpersuasive because the claim as well as the Specification has failed to describe what is "target depth" and to distinguish the "target depth" from a generic depth. Although "predetermined depth" has been recited in numerous patent, it is adequately described " . . . predetermined depth of the substrate, the predetermined depth corresponding to desired light phase shift" in claim 9 of US 6,511,777.

Applicant traverses the 103 rejection of claims 1-10 over Doan ('585) in view of Laxman ('196) and Yao ('564). Applicant argues the failure of Doan to disclose terminating the first etch when the first layer has been etched to a predetermined depth which is less than the target depth and etching the first layer in a second etch by

Art Unit: 1765

contacting the first layer with a reactive chemical gas/plasma. Applicant's argument is unpersuasive because Doan's deficiencies have been acknowledged and are taught by Yao (see Abstract; column 5, line 31 - column 6, line 5; Table 1; column 4; column 5, lines 7-10).

Applicant argues Laxman is irrelevant to the current invention and fails to indicate that layer thickness is a result effective variable in the context of the current method of facet etching. Applicant's argument is unpersuasive because varying the depth of a layer is not germane to a particular application. Purity of the film, thickness, uniformity and deposition rates are some of the strictly controlled parameters to facilitate fabrication of submicron features in a device"(column 2, lines 57-59), which provides evidence that varying the depth of a layer, is a so-called "result effective variable, regardless of the application.

Applicant argues the combination of Yao with the combined teachings of Doan fails to teach the two step etch of the current claims and argues that Yao performs chemical etching prior to plasma etching, which differs from the principle operation of the current claims. Applicant's argument is unpersuasive because although Yao's etching steps are labeled "Etch High," "Etch Low," "Sputter," and "Plasma," they are all etching processes that differ only in the operational conditions. Since each of these steps is performed at a specified time, then using Yao's steps of etching an oxide layer would result in, etching the first layer in a second etch by contacting the first layer with a reactive chemical gas/plasma.

Applicant traverse the 103(a) rejection of claims 11-21 as being unpatentable over Doan in view of Laxman and Yao and further in view of Lee ('875) and argues as above that the combination of the said references fail to disclose the elements of the current claims. Applicant's argument is unpersuasive because Lee is relied upon and teaches the deficiencies, forming a second layer comprising an insulating material superjacent the first layer and the second layer uniformly covers the first layer (see Lee, column 5, lines 29-32 and Figure 6), which are not met by Doan in view of Laxman and Yao.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

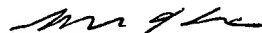
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Art Unit: 1765

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703-308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

ltue
May 3, 2003



BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700